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Journal of the Missouri Native Plant Society

Joanna M. Turner (1929 2002)

George Yatskievych
Flora of Missouri Project
(with lots of help from other friends)

When friends move away, it is easy to lose touch, so it was a big shock to learn that Joanna Turner had passed away. The sad news came as a surprise to her numerous friends in Missouri, most of whom had not even known of her illness. Over the years, Joanna introduced me to so much about Missouri botany and places to botanize, and to so many of the people involved with Missouri plants. Her death was also the end of a big chapter in my life. Joanna is and will be sorely missed.

Joanna Mozley Turner was born in Jacksonville, Florida, on November 13, 1926, the daughter of James M. Mozley and Elizabeth Boyer Mozley. Two brothers, John and James Mozley, currently live in Missouri and New York. Joanna developed a love for the outdoors on family outings to the Smoky Mountains as a child. One of the personal treasures that she kept throughout her life was a small wildflower guide for the Smokes that she had received as a young child.

As a young adult, Joanna's interest in natural history was largely set aside. She attended Washington University, where she received her Bachelor's degree in 1948, and then Northwestern University, where she earned her Master's Degree in Psychology in 1951. Following school, she worked as a vocational counselor with the Red Cross and later with the St. Louis Vocational Counseling Service. Along the way she met a dashing young Washington University medical student named James K. Turner and they were married on June 28, 1952. In 1954, she traded her job for a second career as a housewife and mother. The couple raised a daughter and a son, and celebrated five decades of marriage before Joanna passed away.

When her children were grown, Joanna had more free time and her interests in natural history reawakened. During the 1970s, she began attending botany hikes with the Webster Groves Nature Study Society (WGNSS) and came under the tutelage of Fr. James Sullivan and the late Arthur Christ. She also became close friends with the late Edgar Denison, another dean of Missouri wildflowers. Memberships in WGNSS, the Missouri Prairie Foundation, and later the fledgling Missouri Native Plant Society followed, including active participation in the St. Louis Chapter of MONPS when it was organized in 1984. She served on the WGNSS board and was a board member and secretary for MONPS (as well as serving on committees).

Joanna also was a longtime member of The Nature Conservancy and served as a trustee of the Missouri Chapter. She also was on the board of the Wild Canid Survival and Rescue Center (known locally as the Wolf Sanctuary at the Tyson Field Station).

Her passion for plants caused her to enroll in the late Erna Eisendrath's plant taxonomy course at Washington University (in which she received a grade of "A"). This course not only developed her knowledge of the Missouri flora, but also gave her insights into the world of botanical nomenclature and the extensive literature surrounding plant names.

By the mid-1980s, Joanna was helping Edgar Denison on the editing of later editions of *Missouri Wildflowers*. In 1981, she also started working as a volunteer with Sue Taylor in the Research Division at the Missouri Botanical Garden. There, she began her bibliographic work on Missouri plants. When the Flora of Missouri Project started in 1987 and I arrived at my new job at the Garden in August, 1987, I had a ready-made assistant in Joanna, who provided background research on all manner of things relating to the new project. She was tireless in searching the Garden's library for new distributional records, taxonomic and nomenclatural changes, and other literature relating to Missouri plants.

Joanna also was thorough in her taxonomic and floristic work. When she discovered some unusual leeks at their property in Jefferson County that didn't fit the plants described in Steyermark's *Flora of Missouri*, Joanna searched the literature for clues, locating a recent publication by the Illinois botanist, Almut Jones. She then corresponded with Jones and other botanists, outlining reasons why her plants should be called *Allium burdickii*, a species unknown to most Missouri botanists at that time. This led to a small monograph of Missouri leeks, which was published in *Missouriensis* in 1984. Later studies have validated her work and confirmed this taxon's status as a member of the state's flora.

Joanna's passion for investigating the details of Missouri species through their record in books and papers also manifested itself in her writings (see bibliography at the end of this tribute). Together with Sue Taylor, another MONPS member and Garden employee, she began working on summaries of selected Missouri plant families, some of which were published in Missouriensis in 1985 and 1987.

These summaries drew the attention of Julian Steyermark, who wrote eloquently and at length in Missouriensis cautioning the authors not to accept nomenclatural changes too quickly without sufficient study. Joanna was disappointed by Steycrmark's reaction and wondered later whether he might have been a bit overprotective of the reputation of his *Flora of Missouri*, which by then was already more than two decades old and beginning to show its age. Far from being discouraged, she continued her bibliographic research on various Missouri plant families.

When the Flora of Missouri Project came into being, these summaries of nomenclatural and taxonomic updates and problems fed into the production of the book-length *Catalogue of the Flora of Missouri*, published by the Missouri Botanical Garden in 1990, of which Joanna was very proud. Joanna also spent long hours helping to develop a taxonomic database of the Missouri flora based on the information in the *Catalogue*, and eventually this was made available online through the Garden's World Wide Web site. Her work was recognized by MONPS when she received the Arthur Christ Memorial Research Award in 1988 and by the Missouri Botanical Garden, which awarded her a Volunteer Special Achievement Award in 1989 and a ten-year service recognition pin in 1991.

As early as 1982, Joanna was writing on the flora of the Rocky Mountains, a region whose flora presented a different focus for her botanical interests. She and Jim took a number of trips to Colorado, including one for a course to study the identification and ecology of tundra plants with the noted naturalist Beatrice Willard, who became a friend. In 1991, Joanna and Jim began spending summers in Colorado, having purchased a summer home in Estes Park nestled at the base of a picturesque pine slope along the boundary of Rocky Mountain National Park. Over time, this house was enlarged and, in 1995, the Turners made the decision to relocate there year-round. Once established in Colorado, Joanna and Jim became volunteers for the national park. Joanna conducted botanical surveys, collected plants for the park's herbarium, worked in the greenhouse, and participated in various revegetation projects. She also joined the Colorado Native Plant Society (but always claimed that she preferred MONPS) and led wildflower walks for the Colorado Mountain Club.

In spite of the distance to Missouri, Joanna kept up an active association with friends in St. Louis, the Missouri Native Plant Society, and the Missouri Botanical Garden. Frequent e-mails and less frequent visits allowed her to remain active with the Flora of Missouri Project. During 1997 and 1998, she worked hard, proof-reading the text for volume 1 of the revised *Steyermark's Flora of Missouri*.

Kay and I visited the Turners in 1997 and spent a magical few days in the Estes Park area. Joanna was able to show us some of her special places and favorite plants, including the belly plants of the alpine tundra and wood lily and monk's hood in a secluded seep. Little did we know that this would be our last chance to see her. When her doctors confirmed the onset of Alzheimer's Disease, Joanna chose not to share this sad news with most of her friends. Those who thought of visiting were politely turned away with the news that Joanna currently was not able to navigate the steep slopes of the Rockies because of minor health problems (she had long suffered from knee problems). As she got worse, she and Jim were forced to move to Boulder, where she could receive care not available readily in Estes Park. She continued to decline relatively quickly, and then on September 18, 2002, she was gone.

I will remember Joanna as the person who introduced me to Missouri botanists like Art Christ and Edgar Denison, and to wonderful places like Hickory Canyons. She was the one who took me to task whenever I didn't explain some taxonomic change well enough and who encouraged me to do the work on the Flora of Missouri Project as thoroughly and completely as possible. Joanna also had a bit of the trickster in her, although I could always tell when she was going to get me into trouble by a particular look in her eyes and a special smile. She was a good friend and a pillar of support. She is missed.

BIBLIOGRAPHY OF JOANNA TURNER'S WRITINGS AND REPORTS

Turner, J. 1980. Catechism column: abnormal *Trillium recurvatum*. Missouriensis 2(2):16.

Turner, J. 1981. Book review: Wildflowers of the Ozarks. Missouriensis 3(1):17.

Turner, J. 1982. Autumn hazard for field botanists. Missouriensis 4:55 56.

Turner, J. 1982. Plant distributions in the Rocky Mountains. Nature Notes (Webster Groves) 54:83 84.

Turner, J. 1982. On naming plants. Nature Notes (Webster Groves) 54:74 75.

Turner, J. 1984. Wild leeks in Missouri. Missouriensis 5:132 133.

Turner, J. 1985. Minutes of the Missouri Native Plant Society annual board of directors' meeting, June 8, 1985. Missouriensis 6:2 5.

Turner, J. 1985. New Botany Group Chairman. Nature Notes (Webster Groves) 57:41.

Turner, J. 1985. Minutes of the Missouri Native Plant Society annual board of directors' meeting, September 7, 1985. Missouriensis 6:6 8.

Taylor, M. S., and J. Turner. 1985. Family synopsis for the Missouri flora. Missouriensis 6:28 34.

Turner, J. 1987. Nomenclatural review of the families Ceratophyllaceae and Nymphaeaceae in Missouri. Missouriensis 8:21 31.

Turner, J. 1987. Minutes of the April 23, 1988, board meeting. Missouriensis 8:81 83.

Yatskievych, G., and J. Turner. 1990. Catalogue of the flora of Missouri. Monogr. Syst. Bot. Missouri Bot. Gard. 37:i xii, 1 345.

Turner, J., and G. Yatskievych 1992. County record vouchers for vascular plant species newly recorded for Missouri since 1963. Missouriensis 13:1 24.

Turner, J. 1993. Edgar Denison, 1904 1993. Missouriensis 14: 50 57.

Turner Hill: a Special Fern Place

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(reprinted with permission from *Fiddlehead Forum* 29:11, 17 [2002])

Everybody needs a fern place to visit, through the seasons and over the years, to better understand how weather patterns and changes through the year affect plants. No month or year is ever the same.

My place for ferns is a hill on the Eleven Point River, Oregon County, in the Missouri Ozark Mountains. I grew up in the area and have gone back to visit every month or so for the last forty years. The river curves around the base of the hill about a quarter mile from northwest to southeast. At the northeastern part, the river is against the hill but moves away downstream where a small floodplain allows a road and camping area between the hill and river. The river's altitude is about 500 feet and the top of the hill is about 950 feet.

This area is part of the National Wild and Scenic Rivers System and managed by the US Forest Service. It is an oak-history forest over karst topography. The rock strata at the bottom of the hill are late Ordovician, part of a vast plateau now eroded down to these "mountains". The lower levels are mostly dolomite but the upper third has a lot of chert.

I walk from the campground upriver along the base of the hill. Here *Botrychium virginianum* (rattlesnake fern), *Polystichum acrostichoides* (Christmas fern), *Adiantum pedatum* (maiden hair fern), *Diplazium pycnocarpon* (glade spleenwort), *Equisetum hyemale* (rough scouring rush), *Asplenium rhizophyllum* (walking fern) and *Cystopteris protrusa* (fragile fern) are fairly common. In spring, this is a fairy land of *Isopyrum biternatum* (false rue anemone), *Claytonia virginica* (spring beauty), *Mertensia virginica* (Virginia bluebells), *Phlox divaricata* (wild sweet William), *Uvularia grandiflora* (bellwort), *Stylophorum diphyllum* (celandine poppy), *Cornus florida* (flowering dogwood), *Cercis canadensis* (redbud), *Amelanchier* (serviceberry) species and many other others.

Where the river closes against the bluff, *Asplenium resiliens* (black stem spleenwort) and *Cystopteris bulbifera* (bulblet fern) grow from the rock face over a spring. Past there, *Onoclea sensibilis* (sensitive fern), *Selaginella eclipes* (small spikemoss), and *Equisetum arvense* (common horsetail) grow at the edge of the water, each an isolated patch. *Polypodium polypodioides* (little gray polypody) grows on trees hanging over the river and on rocks higher up. *Hepatica nobilis* (liverleaf) fills much of the space between rocks.

Just past the cave, where the river begins to cut into the hill, I begin climbing up beside the cliff face where the rocks become drier and sunnier with height. I climb past *Woodsia obtusa* (common woodsia), *Asplenium ruta-muraria* (wall rue) and *A. platyneuron* (ebony spleenwort). Near the top of the cliff, one plant of *Pellaea glabella* (smooth cliffbrake) hangs from an undercut. I've never found another but the cliff face is sheer for several hundred feet and may house any number in plants I can't see. Just a little higher, a small outcropping shows off *Cheilanthes feei* (slender lip fern) and another is covered in *Asplenium trichomanes* (maidenhair spleenwort). There are also several clumps of *Cypripedium calceolus* (yellow ladyslipper) in this area that bloom only when the spring and prior year have been wet.

Above this, the outcroppings are very dry but *Asplenium platyneuron*, *Pellaea atropurpurea* (purple cliffbrake) and *Cheilanthes lanosa* (hairy lip fern) are easily found. At the top of the hill, the only ferns are *Pteridium aquilinum* (bracken), which is everywhere but not dense. Some other notable plants here are *Castanea ozarkensis* (Ozark chinquapin), *Rhododendron rosea* (wild azalea), *Vaccinium* (blueberry) species and lots of *Toxicodendron radicans* (poison ivy).

I begin climbing down, still facing the river. The rock faces here have a lot of *Asplenium pinnatifidum* (lobed spleenwort), *A. platyneuron* and *A. rhizophyllum*. I have also found several *Asplenosorus ×ebenoides* (Scott's spleenwort) over the years, often in the same crevice as their parents. They have all been very short-lived, perhaps from an inherent hybrid weakness, but I think because they all grew in less hospitable crevices; their parents occupied the better places. Diligent searching has not produced any other *Asplenium* hybrids here.

Near the bottom of the hill, *Adiantum* and *Polystichum* become common again and grow with *Phegopteris hexagonoptera* (broad beech fern). There was one plant of *Polypodium virginianum* (rock cap fern) on a rock, but it disappeared after I showed it to another person; I believe it is now in an herbarium. I've never found another.

On the wider floodplain there are *Botrychium dissectum* (grape fern) in both *dissectum* and *obliquum* forms, along with many intermediate forms, and more *B. virginianum.* In a sandy patch by a small wet weather stream, *Ophioglossum vulgatum* (adder's tongue fern)grows over an area of more than 300 square feet. *Galearis spectabilis* (showy orchis,) *Liparis liliifolia* (twayblade), *Aplectrum hyemale* (putty root orchid) and many other spring flowers also bloom here.

Missouri ferns are never seen from the roadside; they are special jewels tucked away in hollows and crevices. Ferns I always look for but have not yet found are *Asplenium septentrionale* (forked spleenwort), *Cystopteris tennesseensis* (Tennessee bladder fern), *Argyrochosma dealbata* (false cloak fern), *Adiantum capillus-veneris* (Venus maidenhair fern) and *Thelypteris palustris* (marsh fern). Some have been found nearby and some are just dreams. Maybe next month.

Hot and tired, happy with seeing all my old friends again, I jump in the river and let the swift current carry me a way downstream. I'll be back before long.

(Author's note. Turner Hill, in Oregon County, may be reached as follows: From Highway 19, about 1.5 miles north of Alton or 25 miles south of Winona, take County Road AA about 5 miles; at a sharp bend of this road, there is a sign showing the Turner Mill Access to the left; follow that dirt road about 4 miles to the Eleven Point River; at the river, take the fork that goes left, upriver; drive as far as that road goes and park; Turner Mill is across the river, which can be waded in good weather.)

Rediscovery of *Carex conoidea* (Cyperaceae) at Tucker Prairie in Callaway County and Comments on Its Identification and Habitat Associates

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The range of *Carex conoidea* Schkuhr ex Willd. extends from Newfoundland to Ontario, south to Missouri, Illinois, Ohio, North Carolina, and the northeastern U.S., and it also is disjunct and possibly introduced in Arizona (Radford et al., 1964; Mohlenbrock, 1999; Yatskievych, 1999). The species apparently is absent from the Great Plains (Great Plains Flora Association, 1986). Habitats listed for the species include "bogs," "low ground, and moist grassy places," "wet meadows, wet prairies," and "moist depressions of wet prairies" (Radford et al., 1964; Voss, 1972; Mohlenbrock, 1999; Yatskievych, 1999).

Carex conoidea is known in Missouri from two historical sites (Tucker Prairie in Callaway County and Little Dry Fork in Phelps County) and one extant site (Cook Meadow in Barton County) (Yatskievych 1999). The Tucker Prairie record stems from a June 7, 1940 collection made by W. B. Drew (Steyermark, 1963). Previous attempts by the author, Michael Currier of the Missouri Department of Natural Resources, Brad Jacobs of the Missouri Department of Conservation, and Anton Reznicek of the University of Michigan to relocate *Carex conoidea* at Tucker Prairie were unsuccessful.

On 25 May 2002, while searching for species of *Carex* at Tucker Prairie, I located a large population of *C. conoidea* in a swale none of the above-mentioned investigators had ever searched. On the following day, I returned to the site to obtain an estimate of the number of tufts/clumps and flowering culms by walking transects perpendicular to the swale. These observations led to the discovery of an impressive 575 tufts encompassing a few thousand flowering culms. Following a survey of the swale, I searched remaining swales on the property and located a second population directly west of the original discovery containing an estimated 150

Fig. 1. Culms of *Carex conoidea* showing inflorescence structure.

tufts and several hundred flowering culms. On 4 June 2002, I discovered a small third population at the south end of the prairie containing ca. 25 tufts and ca. 75 flowering culms.

As indicated by Yatskievych (1999), the flowering culms and inflorescence of *C. conoidea* are reminiscent of *C. meadii* Dewey, with which it is associated in the smaller population located at the southern end of the prairie. *Carex conoidea* differs from *C. meadii* by its tufted appearance with often multiple flowering culms; its light green leaves; its scabrous peduncles and culms below the inflorescence; its bracts subtending the uppermost pistillate spikes equaling or exceeding the staminate spike in some flowering culms; and its plump, lustrous-green perigynia with ca. 20 impressed nerves (Figs. 1, 2a). *Carex meadii* is characterized by its long creeping rhizomes with usually one flowering culm per plant; its

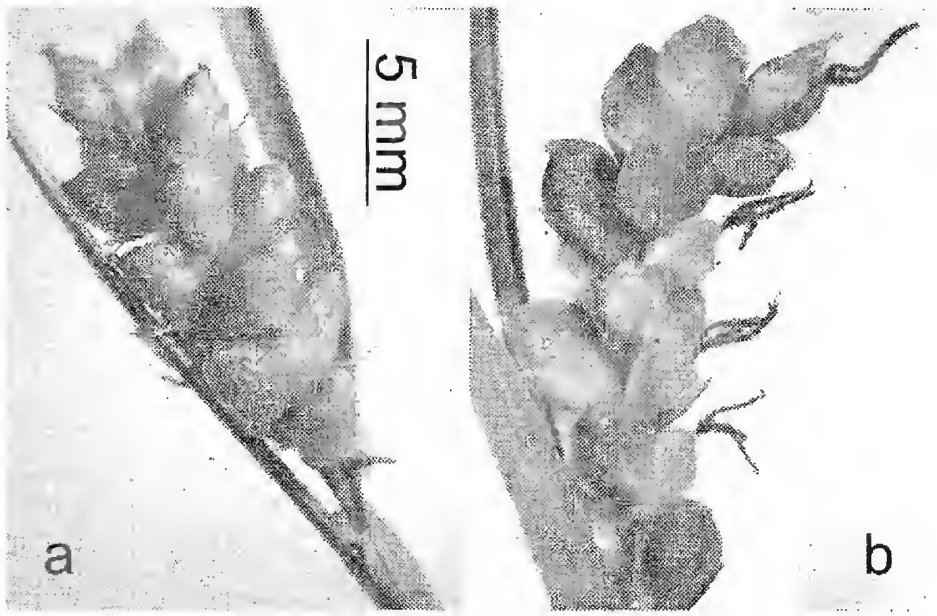

Fig. 2. Spikes showing perigynia of *Carex conoidea* (a) and *Carex meadii* (b).

usually glaucous or gray-green leaves; and its glaucous or gray-green perigynia that have slightly curved beaks and that lack impressed nerves (Fig. 2b). *Carex conoidea* can be distinguished readily from other members of the section Griseae L.H. Bailey in Missouri by the combination of its scabrous peduncles and culms below the inflorescence; the fewer number of impressed nerves (others in the section usually have 40 or more such nerves); and the position of the staminate spike, which is well exserted above the uppermost pistillate spike (Fig. 1).

Various authors (e.g., Steyermark, 1963; Mohlenbrock, 1999; Yatskievych, 1999) have depicted the perigynia of *C. conoidea* as being tapered at both ends. This is undoubtedly due to the fact that illustrators only had access to herbarium specimens or overly mature perigynia, as fresh, mature perigynia of *C. conoidea* are plump and inflated (Fig. 2a), and similar in appearance to those of *C. amphibola* Steud. Upon drying in a plant press, I noted that the perigynia of *C. conoidea* shrink and become tapered at both ends.

At the two largest populations at Tucker Prairie, *C. conoidea* extends from the wetter portions of the swale containing standing water to the drier margins of areas just upslope of the depressions. Despite the field characters listed above, identification of *C. conoidea* in the field can be difficult because many of the tufts may have few flowering culms and the culms often lean on or are hidden

by adjacent, taller vegetation, and as mentioned above, due to its similarity to *C. meadii*.

Associated plants recorded at Tucker Prairie include *Agrimonia parviflora, Amorpha canescens, Antennaria neglecta, Aster* spp., *Baptisia alba* var. *macrophylla, Carex annectens* var. *xanthocarpa, C. bicknellii, C. bushii, C. meadii, C. missouriensis, C. pellita, C. scoparia, C. squarrosa, Eleocharis palustris, E. verrucosa, E. wolfii, Eryngium yuccifolium, Eupatorium perfoliatum, Euphorbia corollata, Fragaria virginiana, Galium* sp., *Helianthus mollis, Heuchera richardsonii, Hypoxis hirsuta, Koeleria macrantha, Juncus diffusissimus, Juncus interior, Melanthium virginicum, Parthenium integrifolium, Platanthera lacera, Potentilla simplex, Pycnantheum tenuifolium, Rosa carolina, Scirpus atrovirens/georgianus, Senecio pauperculus, Silphium integrifolium, Sisyrinchium campestre*, and *Tradescantia ohiensis*.

VOUCHER DATA. **Callaway County**: Tucker Prairie, ca. 2.75 mi WSW of the intersection of Interstate 70 and Route 54 in Kingdom City; T48N R10W S12 NE1/4 of NE1/4 of SW1/4, Kingdom City 7.5' Quad; ca. 575 tufts and a few thousand flowering culms in large swale just W of sharp right-hand turn of county road N of maintenance building and directly adjacent to I 70; tufts scattered in recently burned prairie; most flowering culms leaning on or hidden among adjacent vegetation, 25 May 2002, *P.M. McKenzie 2006* (MO, MICH, UMO, Charles Bryson herbarium).

As suggested by some botanists, the relatively large number of tufts and flowering culms of *C. conoidea* this year at Tucker Prairie may be in response to a combination of prescribed fire conducted earlier in the spring and the abundant rainfall received in April and May. The presence of this species currently only at Tucker Prairie and Cook Meadow (Barton County) suggests that *C. conoidea* may be a good indicator of high-quality, well-managed prairies, or reflect the lack of survey efforts in other prairies by individuals familiar with field characters of the species. Searches by the author in five prairies in Benton and Pettis counties in early June 2002 failed to yield additional populations. Nonetheless, future searches for *C. conoidea* should be conducted in other high-quality prairies throughout the state between approximately 20 May and 10 June depending on the latitude of the locality to be surveyed.

ACKNOWLEDGMENTS

I am grateful to Mike Currier of the Missouri Department of Natural Resources, George Yatskievych of the Flora of Missouri Project, and Paul Nelson of the U.S. Forest Service for their assistance with this report.

LITERATURE CITED

Great Plains Flora Association, eds. 1986. Flora of the Great Plains, University Press of Kansas, Lawrence.

Mohlenbrock, R. H. 1999. The Illustrated Flora of Illinois. Sedges: Carex. Southern Illinois University Press, Carbondale.

Radford, A. E., H. E. Ahles, and C. R. Bell. 1964. Manual of the Vascular Flora of the Carolinas. University of North Carolina Press, Chapel Hill..

Steyermark, J. A. 1963. Flora of Missouri. Iowa State University Press, Ames [errata added at 2nd printing, 1968].

Voss, E. G. 1972. Michigan Flora. Part 1. Gymnosperms and Monocots. Cranbrook Institute of Science, Bloomfield Hills, MI.

Yatskievych, G. 1999. Steyermark's Flora of Missouri, revised ed., vol. 1. Missouri Department of Conservation, Jefferson City.

Comments on *Carex timida* (Cyperaceae) in Missouri and a Key to Species of Section *Phyllostachyae* in the State

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During preparations for the upcoming treatment of *Carex* in the *Flora of North America* series, Rob Naczi of the Claude E. Phillips Herbarium in Dover, Delaware, and Bruce Ford of the University of Manitoba in Winnipeg, Manitoba, noticed specimens of a *Carex* within *Section Phyllostachyae* that did not fit any of the previously described species. Based on this and other work (e.g., Naczi and Ford, 1998; Starr et al., 1999; Ford and Naczi, 2001), it was determined that the new taxon was part of the *Carex jamesii* Schwein. complex.

Naczi and Ford (2001) also discussed why the sectional name for the group including the *C. jamesii* Schwein. complex should be *Phyllostachyae* Tuck. ex Kük., as suggested by such authors as Mackenzie (1935), Fernald (1950), and Gleason & Cronquist (1991), rather than *Phyllostachys* (J. Carey) L.H. Bailey, as recommended by Catling et al. (1993), and others. Naczi and Ford (2001) conducted a morphometric analysis of the *C. jamesii* clade. They determined that three taxa were distinct from one another at the species level: *C. jamesii, C. timida,* and *C. juniperorum* Catling, Reznicek & Crins. Acknowledgment of *C. timida* as a distinct species was further confirmed by analysis of allozyme variation (Ford and Nazci, 2001). Although *C. timida* superficially resembles the common and more widespread *C. jamesii,* Naczi and Ford's research showed that the new species is more closely related to *C. juniperorum,* which is restricted to southeastern Ontario, south-

western Virginia, southern Ohio, and adjacent northeastern Kentucky (Catling et al. 1993; Naczi and Ford 2001).

Based on an examination of more than 1,950 specimens within the *C. jamesii* complex and field investigations in Ontario and 13 states in the eastern United States, Naczi and Ford (2001) documented the occurrence of *C. timida* only at 28 sites in 20 counties in the following eight states: Alabama, Arkansas, Indiana, Kentucky, Missouri, Ohio, Oklahoma, and Tennessee. The sole Missouri record listed by Naczi and Ford (2001) originally had been identified as *C. jamesii* and was collected in Taney County: 6 mi SE of Protem, 4 mi S of Ocie, in Big Cedar Hollow, just W of Taney County line, section 18, 30 Apr 1938, *Steyermark 5303* (MO, NA).

Naczi and Ford (2001) provided the following comments on the habitat for *C. timida*:

> "The usual habitat of *Carex timida* is in relatively open (sometimes closed) mesic deciduous and deciduous-juniper woodlands. Populations often occur on high slopes and on hilltops, far from streams. The substrates are loams and clay-loams that are apparently calcareous. The substrates are often rocky, with limestone at or near the surface at several sites. Among the closely associated vascular plants species are *Acer saccharum*, *Aristolochia serpentaria*, *Carex blanda*, *C. cephalophora*, *Carya* spp., *Cercis canadensis*, *Juniperus virginiana*, *Quercus* spp., and *Ulmus* spp."

The approximate location of Steyermark's collection was determined to be on the 7.5' Protem, Missouri, topographic map. Given that the approximate location was in or adjacent to Bull Shoals Lake, which was constructed after Steyermark's collection, and the fact that we could not pinpoint Steyermark's exact locality, it was not known whether the historical site was still extant or had become flooded following reservoir construction.

In mid-April, 2002, the authors obtained landowner permission to access the vicinity of Steyermark's collection locality and on 30 April we searched dry upland woodlands and glades above the lakeshore. These efforts led to the discovery of an estimated 550 clumps of *C. timida* scattered within small, partially shaded openings within a dry dolomite forest with an overstory of *Juniperus ashei*, *J. virginiana*, *Quercus muehlenbergii*, *Q. rubra*, and *Q. stellata*. Associated plants in the understory include *Acer*

saccharum, Berchemia scandens, Bumelia lanuginosa ssp. *oblongifolia, Carex albicans* var. *albicans, C. eburnea, C. oligocarpa, Cercis canadensis, Comandra umbellata* ssp. *umbellata, Cotinus obovatus, Danthonia spicata, Dodecatheon meadia, Erythronium albidum, Glandularia canadensis, Hypoxis hirsuta, Lithospermum canescens, Oxalis violacea, Parthenium integrifolium, Rhamnus caroliniana, Rhus aromatica, Schizachyrium scoparium, Scleria oligantha, Solidago* sp., and *Tridens flavus.*

Although *Carex timida* is most closely related to *C. juniperorum,* a species not known from Missouri (Catling et al., 1993; Yatskievych, 1999, Naczi and Ford, 2001), *C. timida* superficially resembles *C. jamesii.* It differs in its lighter green leaves, usually smaller stature, a reddish purple base, usually shorter perigynia and perigynium beaks, greater ratio of the lowermost staminate spike scale to the overall length of the spike, shorter staminate spike that usually does not exceed the tips of the perigynia beaks, and the fused base of the first scale (Fig. 1). *Carex jamesii* is characterized by its darker green leaves, lack of a reddish purple base, smaller ratio of the lowermost staminate spike scale to the overall spike length, longer staminate spikes that usually exceed the tips of the perigynium beaks, longer perigynia and perigynium beaks, and the lack of fusion of the base of the first scale on the staminate spike. For a more complete description and illustrations of *C. jamesii*, see Yatskievych (1999) and Naczi and Ford (2001).

In areas where *C. timida* occurs near *C. jamesii*, *C. timida* is usually found in slightly drier microsites than *C. jamesii* (Naczi and Ford 2001). The list of associated species given above for the Taney County site provides additional support for suggestions of habitat preferences of *C. timida* made by Naczi and Ford (2001). At the Taney County site, we noted that *C. timida* was generally found in the smaller, well-shaded openings, and not in the larger open, unshaded areas of the surrounding forest. The association of *C. timida* at the Missouri station in part with *Juniperus ashei* apparently is the first time this sedge has been found in the understory of this juniper species (Rob Naczi, pers. comm., May, 2002). In its association with juniper woodlands in parts of its range (Naczi and Ford 2001), *C. timida* shares similar ecological parameters with *C. juniperorum* whose specific epithet reflects the occurrence of that species in habitats dominated by *Juniperus virginiana.*

Given the abundance of similar habitat in southern Missouri and northern Arkansas, especially areas adjacent to the White River, we predict that additional populations of *C. timida* are likely to be discovered with additional survey efforts.

VOUCHER DATA. **Taney County,** COE land above Bull Shoals Lake, ca. 3 mi SSE of Schoolhouse Spring, ca. 5mi ESE of Protem, MO; T21N, R17W, S13 N4 of NW4 of NE4 & S12 S4 of SW4 of SE4; Protem 7.5' Quad.; scattered colonies encompassing ca. 550 plants within small, partially shaded openings of dry dolomite woodland of *Juniperus ashei, J. virginiana, Quercus muehlenbergii, Q. rubra,* and *Q. stellata;* 30 Apr 2002, P.M. McKenzie 1987 (DOV, MICH, MO, UMO, Charles Bryson herbarium).

KEY TO SPECIES OF *CAREX* SECTION *PHYLLOSTACHYAE* IN MISSOURI (adapted in part from Naczi and Ford 2001)

1. Spikes with (3)4 9 perigynia; perigynia with the body elliptic-obovate in outline, conspicuously longer than wide ..... *C. willdenowii*
1. Spikes with (1)2 or3(4) perigynia; perigynia with the body orbicular to obscurely trigonous, about as long as wide
   2. Leaves dark green; plants lacking a reddish purple base; longest (per plant) staminate portion of terminal spike (4.9)5.8 3.5 mm long; basal staminate scale 1.1 1.8(2.1) mm long, 13 26(35)% of length of staminate portion of terminal spike, often exceeding the tips of the perigynium beaks, the margins free the entire length; perigynium beaks (1.9)2.3 3.9 mm long, 39 53% of perigynium length ..... *C. jamesii*
   2. Leaves light green; plants with reddish purple bases; longest (per plant) staminate portion of terminal spike 3.4 5.6 (6.2) mm long; basal staminate scale (1.9) 2.1 3.3 mm long, (35)44 77% of length of staminate portion of terminal spike, rarely exceeding the tips of the perigynium beaks, the margins fused nearly the entire length of the scale; perigynium beaks 1.4 2.3 (2.5) mm long, 34 44% of perigynium length ..... *C. timida*

ACKNOWLEDGMENTS

We are grateful to Rob Naczi, Anton Reznicek, and George Yatskievych for their assistance with this project. We are indebted to John and Marty Arnold, Ozark Underground Laboratory, Protem, Missouri, for assistance in gaining access to private property adjacent to the collection site.

LITERATURE CITED

Catling, P. M., A. A. Reznicek, and W. J. Crins. 1993. *Carex juniperorum* (Cyperaceae), a new species from northeastern North America, with a key to *Carex* sect. *Phyllostachys*. Syst. Bot. 18:496 501.

Fernald, M. L. 1950. Gray's manual of botany, ed. 8. American Book Co., New York,.

Ford, B. A., and R. F. C. Nazci. 2001. Genetic diversity in the *Carex jamesii* complex (Cyperaceae: Sect. *Phyllostachyae*) with insights into the evolution and origin of the newly described species *Carex timida*. Sida 19:885 897.

Gleason, H. A., and A. Cronquist. 1991. Manual of Vascular Plants of Northeastern United States and Adjacent Canada, ed. 2. New York Botanical Garden, Bronx.

Mackenzie, K. K. 1935. Cyperaceae Cariceae. N. Amer. Fl. 18: 169 478.

Naczi, R. F., and B. A. Ford. 1998. Systematics of the *Carex jamesii* complex (Cyperaceae: Sect. *Phyllostachys*, Cyperaceae). Amer. J. Bot. 85(6, suppl.):147 [abstract].

. 2001. Systematics of the *Carex jamesii* complex (Cyperaceae: Sect. *Phyllostachyae*). Sida 19:853 884.

Starr, J. R., R. J. Bayer, and B. A. Ford. 1999. The phylogenetic position of *Carex* section *Phyllostachyae* and its implications for phylogeny and subgeneric circumscription in *Carex* (Cyperaceae). Amer. J. Bot. 86:563 577.

Steyermark, J. A. 1963. *Flora of Missouri*. Iowa State University Press, Ames [errata added at second printing, 1968].

Yatskievych, G. 1999. Steyermark's Flora of Missouri, revised ed., vol. 1. Missouri Department of Conservation, Jefferson City.

Yatskievych, G., and J. Turner. 1990. Catalogue of the flora of Missouri. Monogr. Syst. Bot. Missouri Bot. Gard. 37:i xii, 1 345.

Fig. 1. Inflorescence of *Carex timida*. Note the short staminate spike.

Three New Sites for *Eleocharis atropurpurea* (Cyperaceae) in Missouri and Comments on its Identification and Ecological Requirements

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Eleocharis atropurpurea (Retz.) Kunth is a pantropical species (Godfrey and Wooten, 1979; Yatskievych, 1999) that is scattered in North America (British Columbia, Alabama, California, Georgia, Florida, Iowa, Louisiana, Michigan, Missouri, Nebraska, New Mexico, North Carolina, Oklahoma, South Carolina, Texas, and Washington), including the Great Plains (Great Plains Flora Association, 1986; S. Galen Smith, Univ. of Wisconsin, pers. comm., Aug. 2002). Habitat listed for the species includes "sandy, moist areas, low prairies, margins of ponds" (Great Plains Flora Association, 1986); "sandy to muddy shores, playas, and other drying sites" (Rolfsmeier, 1995); "mudflats near edge of marsh" (Yatskievych, 1999), and "wet fresh to brackish soils, often in shallow water" (Godfrey and Wooten, 1979).

Eleocharis atropurpurea was known previously in Missouri from a single collection made in 1982 at the Missouri Department of Conservation's Little Bean Marsh Conservation Area on a mud flat of an oxbow lake within the Missouri River floodplain near Kansas City in Platte County (Castaner, 1984; Yatskievych, 1999). Subsequent multiples searches at Little Bean Marsh by the author and others have failed to rediscover the species at this locality.

During the monitoring of sites for *Schoenoplectus hallii* (A. Gray) S.G. Sm. (Hall's bulrush) in Scott County, Missouri on September 9, 2002, the author discovered three sites for *E. atropurpurea* in wet sand habitat that was created by extended flooding conditions in the region during May August 2002. The discovery of *E. atropurpurea* in Scott County extends the known range of the species in Missouri approximately 630 km (ca. 390 mi) southeast of the historical locality. Two of the new localities were new sites for the rare *S. hallii* where suitable habitat had not existed

Fig. 1. Habits of *Eleocharis atropurpurea* (center) and *Eleocharis ovata* (right) in the field in Scott County, Missouri.

in recent years. Associated species common at the three new sites were *Eleocharis ovata, Fimbristylis autumnalis, Lindernia dubia, Mollugo verticillata, Rotala ramosior,* and *Schoenoplectus hallii.* Other species recorded at two or fewer sites were *Cyperus polystachyos, Echinodorus tenellus* var. *parvulus, Eleocharis acicularis, Eryngium prostratum, Lipocarpha micrantha,* and *Rhexia virginica*

Eleocharis atropurpurea is a rare associate of *Schoenoplectus hallii* at some other sites in the central United States. During a visit by the author to the Wichita Mountains National Refuge near Lawton, Oklahoma on July 28, 2002, *S. hallii* was growing with *E. atropurpurea* at one site in sandy loam soil *(McKenzie 2032* [MO]). Anton Reznicek of the University of Michigan reported that *E. atropurpurea* is an associate in wet, sandy soil at the only two known sites of *S. hallii* in Michigan (pers. comm., Sep. 2002), and Bob Steinhauer indicated that the two species occur together at a few sandy sites in the eastern Nebraska Sandhills (Steinhauer, 2001, and pers. comm., Sep. 2002).

The annual habit of *E. atropurpurea* somewhat resembles that of a diminutive *E. lanceolata* Fernald or *E. ovata* (Roth) Roem. & Schult. (Rolfsmeier, 1995). The latter is a common associate of *E. atropurpurea* (Fig. 1), differing in its smaller, thinner culms

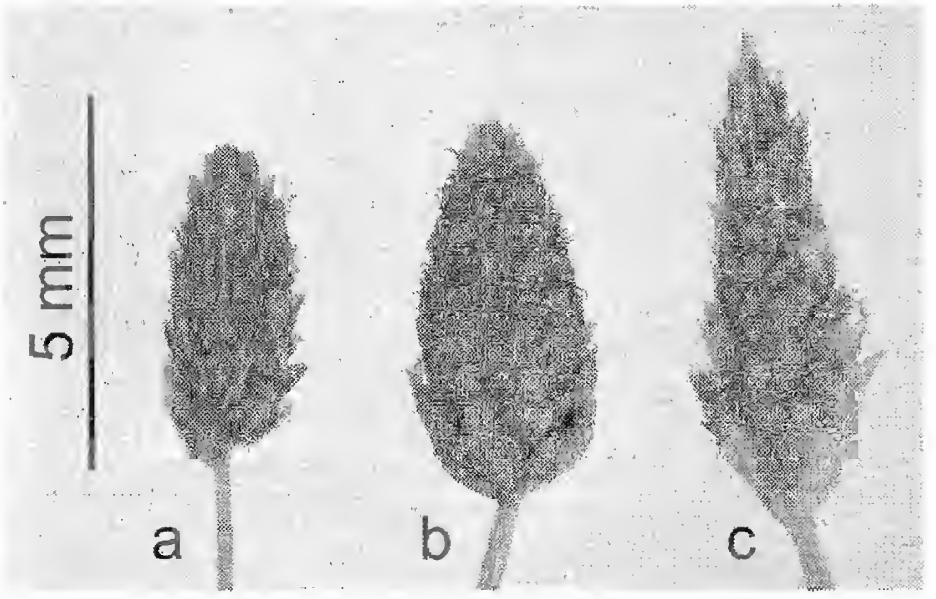

Fig. 2. Spikes of three species of *Eleocharis*: a) *E. atropurpurea*, b) *E. ovata*, c) *E. lanceolata*.

(0.2 0.3 mm wide); smaller, generally tapered spikes (Fig. 2); purplish-tinged scales (Fig. 3); smaller achenes (only 0.5 0.6 mm long) that are shiny black or purplish black at maturity (Fig. 3); smaller tubercles only ca. ¼ the width and situated in the center of the achene summit (Fig. 3); and reddish purple tinged culm bases (Fig. 4). Although some specimens of *E. lanceolata* and *E. ovata* previously treated by various authors as *E. obtusa* var. *detonsa*, *E. obtusa* var. *engelmannii*, or *E. engelmannii* (see discussion on the synonymy of this species in Yatskievych, 1999), may have long cylindrical and tapered spikes and can have reddish purple culm bases, the culm width (0.5 2.0mm); achene length (0.8 1.5 mm); achene color (yellow to brown), tubercle shape (tubercle base parallel with nearly the entire width of summit of achene), and the lack of purple on spikelet scales will easily discriminate them from *E. atropurpurea*. *Eleocharis atropurpurea* tends to have many more culms per clump (Fig. 1) than *E. lancelolata* or *E. ovata*. This gives the plant a somewhat more bushy, wiry, or tufted appearance. Nonetheless, the size, shape, and color of achenes (Fig. 3) will easily separate *E. atropurpurea* from all other species of *Eleocharis* documented for Missouri.

Due to its annual habit, reddish purple culm bases, and shiny black to purplish black achenes, *E. atropurpurea* may also resemble somewhat *E. geniculata* (L.) Roem. & Schult., a species that occurs in similar habitats in states to the east and west of Missouri (S.

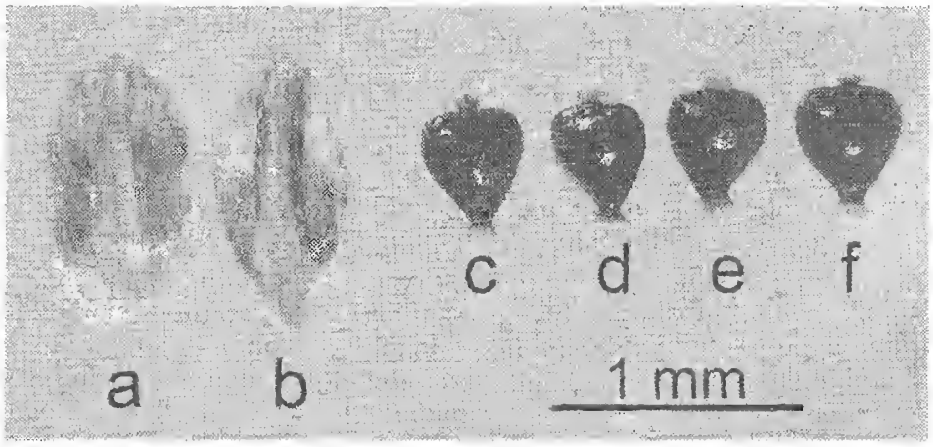

Fig. 3. Scales and achenes of *Eleocharis atropurpurea*: a) scale, dorsal side; b) scale, ventral side; c f) representative achenes (note narrow tubercles).

Galen Smith, pers. comm., 11 Sep. 2002). *Eleocharis geniculata* differs from *E. atropurpurea* in its usually thicker culms (0.4 1.0mm), more globose to ovoid spikes, opaque or pale scales that lack purple coloration, larger achenes (0.7 1.1mm), and its usually persistent perianth bristles that remain attached to the achenes at maturity.

The failure to discover *E. atropurpurea* in Scott County until September 2002 is probably due to local hydrological changes rather than simply being overlooked in the field, for the following reasons: 1) the author has been searching for the species in various wetland habitats throughout the state since 1995; 2) one of the sites (Charles Scherer's property) for *E. atropurpurea* has been the target of extensive field research, especially involving the annual monitoring of *Schoenoplectus hallii* there since 1993; 3) the species is not likely to be confused with any other species of *Eleocharis* in Missouri if mature achenes are examined with a hand lens.

It is likely that *E. atropurpurea* requires extended periods of flooding to germinate, as occurred in Scott County during the summer of 2002. The flooded conditions apparently were responsible for creating suitable habitat for four new Scott County sites of *Schoenoplectus hallii* and two new localities for *Echinodorus tenellus* var. *parvulus*. Research by Drs. Jerry and Carol Baskin of the University of Kentucky at Lexington and Dr. Marian Smith of Southern Illinois University at Edwardsville have provided evidence that the germination of *S. hallii* achenes requires extended

periods of flooding before dormancy can be broken (Baskin et al., in press). *Eleocharis atropurpurea* sites in Scott County were submerged for extended periods between May and August 2002 (Marian Smith, pers. comm., 9 Sep. 2002) and the species was later in association with *S. hallii* at each locality. Thus, the flooded conditions that provided suitable habitat for *S. hallii* probably provided a favorable germination environment for *E. atropurpurea*. Given the current discovery of populations in wet sandy soil in Scott County and the documentation of the species in similar habitats in Michigan, Nebraska, and Oklahoma, *E. atropurpurea* should be searched for in wet sand in other areas of the state, especially following extended flood events.

VOUCHER DATA. **Scott County**: Blodgett, S side of Route U, just W of intersection with the Interstate 55 overpass; T27N R14E S12 NE4 of NW4 of NW4 of NW4; Morley 7.5' Quad.; tens of thousands of plants in low depression, 9 Sep 2002, *P. M. McKenzie 2055* (MO, MICH, UMO, WIS). Westvaco *Populus deltoides* plantation, N of County Road 506, ca. 1.5 mi WNW of intersection of Routes D and 77; T28N R14E S34 NE4 of SE4 of SW4; Thebes SW 7.5' Quad; a few hundred clumps scattered in low depression of plantation with cottonwood seedlings, 9 Sep 2002, *P. M. McKenzie 2058* (MO, MICH, UMO, WIS). Property of Charles Scherer, W side of County Road 505, just N of County Road 506, ca. 1.3 mi ENE of intersection of Routes C and H, ca. 0.3 mi. N of intersection of County Roads 505 and 506; T28N R14E S33 NE4 of NE4 of SE4; Morley 7.5' Quad; several hundred plants along edge of sandy swale, 9 Sep 2002, *P. M. McKenzie 2059* (MO, MICH, UMO, WIS).

The discovery of *E. atropurpurea* in the above-mentioned sand prairie sites adds to an ever growing list of native taxa that have been documented from this area. Following the Nature Conservancy and Missouri Department of Conservation's ranking system for state-listed species, no less than 41 species of conservation concern have been recorded from the Scott County sand prairies, including 25 critically imperiled (S1) and 10 imperiled (S2) species, two S1/S2 species, one rare and uncommon species (S3); two S2/S3 species, and one species whose status is uncertain but for which there are few records in the state. These include: *Aristida desmantha, A. lanosa, Carex alata, C. albicans* var. *australis, C. comosa, C. longii, C. oxylepis, Carya pallida, Chamaesyce geyeri, Conyza canadensis* var. *pusilla, Crotonopsis linearis, Cyperus compressus, C. croceus, C. grayoides, C. hystricinus, C. plukenetii, C. polystachyos, C. retroflexus, C. retrofractus, Des-*

modium strictum, Echinodorus tenellus var. *parvulus, Eleocharis atropurpurea, Hedyotis boscii, H. uniflora, Helianthus angustifolius, Hypericum adpressum, Ludwigia leptocarpa, Malus angustifolia, Monarda punctata* var. *occidentalis, Panicum hians, P. verrucosum, Paspalum bifidum, Polygonella americana, Polypremum procumbens, Rhynchosia difformis, Sacciolepis striata, Schoenoplectus hallii, Sisyrinchium atlanticum, Stylisma pickeringii* var. *pattersonii, Trichostema setaceum*, and *Xyris jupicai* (Missouri Natural Heritage Program, 2001). The sand prairies of the Missouri Bootheel also provide habitat for the Illinois chorus frog (*Pseudacris streckeri illinoensis*, a S2 species). Despite this impressive list and numerous recommendations by this author and others to protect remnants of this critically imperiled (G1) natural community, there are currently no sand prairies in Scott County or adjacent areas in Mississippi, New Madrid or Pemiscot counties that are under public ownership. Most sand prairies in this area are threatened by residential, recreational, or commercial development (especially conversion of sand prairies to cottonwood plantations for pulpwood production), and/or the application of chemicals for weed control. Unless additional support can be generated to protect these areas and immediate steps are taken to place selected tracts in public ownership, some of the unique plant species characteristic of the Missouri Bootheel sand prairies may be lost forever.

ACKNOWLEDGMENTS

I thank landowners Charles Scherer and Donnie Beggs for granting access to their land and Marsha Eison of the Mead Westvaco Corporation for permission to survey potential habitat on Westvaco property. I am grateful to S. Galen Smith and Craig Freeman for providing information on the identification and distribution of *E. atropurpurea* and *E. geniculata*. Anton Reznicek and Bob Steinhauer provided valuable information on sites for *E. atropurpurea* in Michigan and Nebraska, respectively. Galen Smith and Francis Menapace provided useful comments on an earlier draft of the manuscript.

LITERATURE CITED

Baskin, C. C., J. M. Baskin, E. W. Chester, and M. Smith. In press. Ethylene as a possible seed germination cue for *Schoenoplectus hallii* (Cyperaceae), a rare summer annual of occasionally flooded sites. Amer. J. Bot.

Castaner, D. 1984. Two additions to the flora of Missouri from Little Bean Marsh. Missouriensis 5:106 108.

Godfrey, R. K., and J. W. Wooten. 1979. Aquatic and Wetland Plants of the Southeastern United States. Monocotyledons. University of Georgia Press, Athens.

Great Plains Flora Association, eds. 1986. Flora of the Great Plains. University Press of Kansas, Lawrence.

Missouri Natural Heritage Program. 2001. Missouri Species of Conservation Concern Checklist. Missouri Department of Conservation, Jefferson City.

Rolfsmeier, S. B. 1995. Keys and distributional maps for Nebraska Cyperaceae, part 1: *Bulbostylis, Cyperus, Dulichium, Eleocharis, Eriophorum, Fimbristylis, Fuirena, Lipocarpha,* and *Scirpus*. Trans. Nebraska Acad. Sci. 22:27 42.

Steinhauer, R. F. 2001. 2000 Survey for Hall's Bulrush (*Schoenoplectus hallii* (Gray) S.G. Smith in the Eastern Sandhills of Nebraska. Final report to the Nebraska Game and Parks Commission, Lincoln.

Steyermark, J. A. 1963. *Flora of Missouri*. Iowa State University Press, Ames [errata added at second printing, 1968].

Yatskievych, G. 1999. Steyermark's Flora of Missouri, revised ed., vol. 1. Missouri Department of Conservation, Jefferson City.

Yatskievych, G., and J. Turner. 1990. Catalogue of the flora of Missouri. Monogr. Syst. Bot. Missouri Bot. Gard. 37:i xii, 1 345.

A New Escaped Species in Missouri: *Evodia daniellii* (Rutaceae)

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Evodia daniellii (Benn.) Hemsl. (Korean evodia; Rutaceae) was found in central Springfield (Greene County) in a weedy section of McDaniel Park, on the northwest side of the intersection of National Avenue and Sunset Street. *Evodia daniellii* (originally spelled *Euodia*) is a small landscape tree from eastern China, Japan, and Korea, introduced to the United States horticulturally in 1905, which can grow in Arnold Hardiness Zones 4 to 8 (Dirr, 1990). Because the tree is not particularly common in landscaping, finding it escaped along this section of the Ozark Greenways, a set of trails that runs through Springfield and the surrounding area, was surprising. The weedy section of trees where *Evodia* occurs is bordered by grass lawns to the east and west. Growing immediately adjacent to or on *Evodia* are *Lonicera japonica*, *Fraxinus pennsylvanica*, *Solidago* spp., *Elaeagnus umbellata*, *Maclura pomifera*, *Vitis* spp., *Rosa multiflora*, *Celtis occidentalis*, *Sassafras albidum*, and *Prunus serotina*. Other associated species include *Quercus palustris*, *Symphoricarpos orbiculatus*, *Ulmus* spp. (including escaped *U. pumila*), *C. laevigata* (or *C. occidentalis* × *C. laevigata*), *Cephalanthus occidentalis*, *Salix nigra* (in some of the wetter ditches), *Zanthoxylum americanum*, *Lonicera maackii*, *Rubus* spp., *Rhus copallina*, and *Liquidambar styraciflua*. The area includes several fields, a rectangular overgrown fence row with a creek/wet ditch, and a small wooded area.

Representative Specimens. **Greene County:** 100m W of National Avenue, 100m S of Sunset Street along middle wooded section of McDaniel Park. 37°10.08'N; 93°16.68'W, elevation 396 m, 22 Oct 2002, *Bowe 90.02* (SMS 65365), and 6 Nov 2002, *Bowe 99.02* (SMS 65362).

The woody plants in this section of McDaniel park are not landscaped and are weedy conglomerates of trees, shrubs, and vines, making it evident that *Evodia* was not intentionally planted

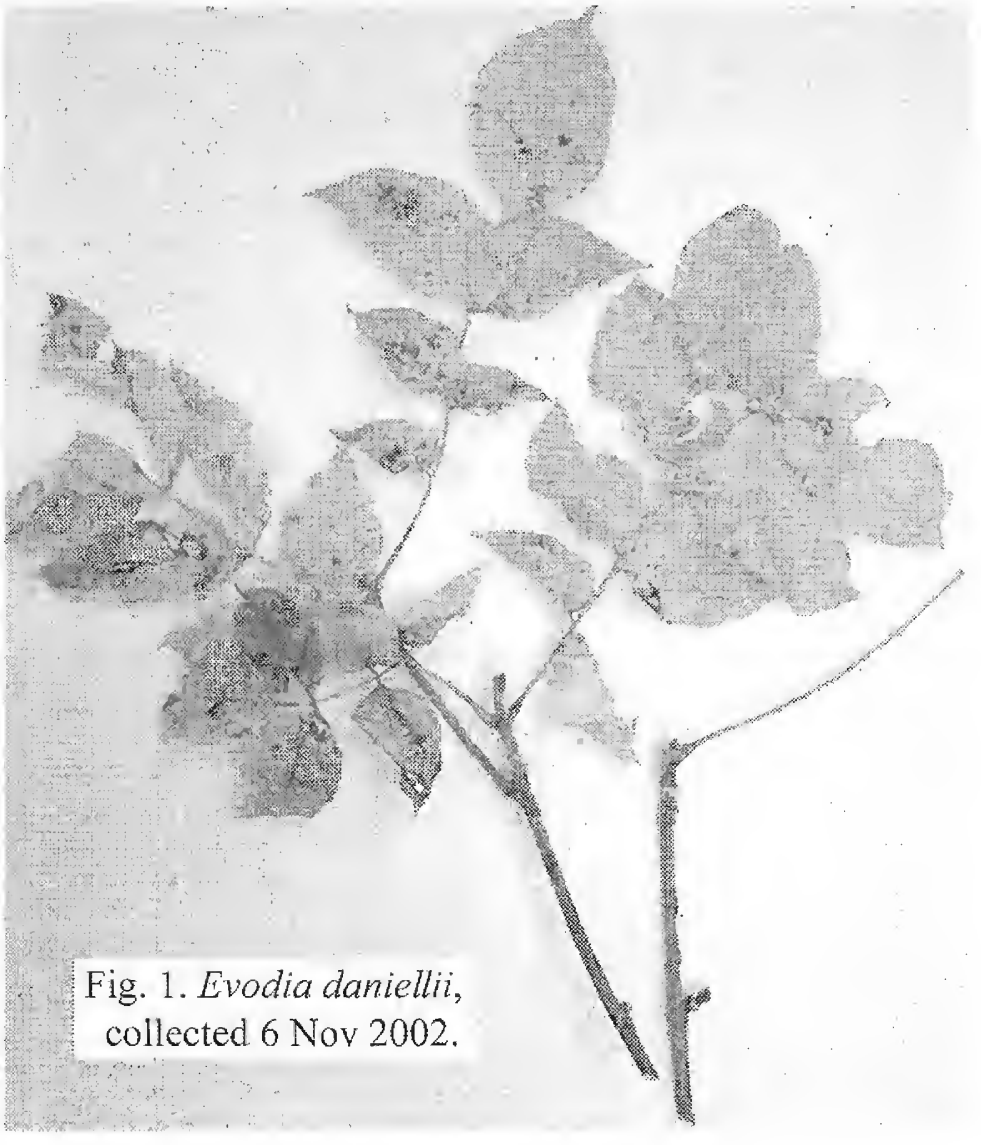

Fig. 1. *Evodia daniellii*, collected 6 Nov 2002.

there. The single tree found did not appear to be in a reproductive state, as no fruit or fruit remnants were found. The park is in an area used for hiking, bicycling, and dog-walking and is bordered to the north and east by residential areas. Although we have not yet discovered the parent tree(s), we suspect that it must have been planted somewhere in the surrounding neighborhoods.

Evodia superficially resembles *Fraxinus* because of its opposite to subopposite pinnately compound leaves (Fig. 1). However, *Evodia* has indistinct scales (Dirr, 1990) that make the terminal bud appear naked, silvery to coppery hairs on the buds, and lobed leaf scars with three groups of bundle scars (Fig.2). It also resembles another landscape species in Rutaceae: *Phello-*

Fig. 2. Twig of *Evodia daniellii*.

dendron amurense Rupr. However, the petioles of *Phellodendron* surround the bud whereas those of *Evodia* are clearly visible.

Although *Phellodendron* is known to escape elsewhere in the United States (TNC Welland Invasive Species Team, 2002; Nature serve Explorer, 2001) *Evodia* has not been reported as a potentially problematic species, despite being "easily propagated by seed" (Schwellen, 1992). Therefore, the discovery of this species escaped in a park in Missouri is important because of potential implications for native habitat conservation and exotic species concerns.

Below is a key that includes both *Evodia* and *Phellodendron* this follows the characters used in the General Key from Steyermark's (1963) *Flora of Missouri*.

KEY TO TREES OR SHRUBS WITH OPPOSITE, PINNATELY COMPOUND LEAVES WITH 5 11 LEAFLETS

A. Leaflets with 1 4 teeth per cm or entire, flowers greenish or purplish, fruit with 1 or 2 wings ..... *Acer negundo*, *Fraxinus*

A. Leaflets entire or with close and crowded teeth 4 12 per cm; flowers white or greenish; fruit a berry, drupe, or capsule, but not winged

B. Leaflets toothed ..... *Sambucus* (Caprifoliaceae), rarely Staphyleaceae

B. Leaflets entire ..... Rutaceae (C)

C. Fruit a drupe; buds enclosed by the petiole ..... *Phellodendron*

C. Fruit a capsule; buds visible, not enclosed, terminal bud appearing naked ..... *Evodia*

LITERATURE CITED

Dirr, M. A. 1990. Manual of Woody Landscape Plants, ed. 4. Stipes Publishing Co., Champaign, IL.

Schwellen, M. A. 1992. *Evodia*. American Nurseryman 176(6):130.

Steyermark, J. A. 1963. Flora of Missouri. Iowa State University Press, Ames [errata added at second printing, 1968].

The Nature Conservancy's wetland invasive species team web page (updated May 2002): http://tncweeds. ucdavis. edu/ photos. html.

Nature serve Explorer: An online encyclopedia of life [web application]. 2001. Version 1.6. Nature serve, Arlington, VA. Avail-able at: http://www.natureserve.org/explorer (Accessed: Nov-ember 21, 2002).

A Vegetative Key to Missouri Goldenrods

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Identifying goldenrods to species level, especially in the vegetative state, is notoriously difficult due to the diversity of the genus and subtle differences among species. This difficulty often serves as a barrier to the accurate and timely collection of field data by public and private conservation agencies in the state and also impedes the interests of the curious observer. Although Speyermark's (1963) treatment bases 25 of 29 couplets on vegetative qualities, the remaining 4 occur early in the key and thus subordinate vegetative characters to floral ones. The following key attempts to facilitate the identification of all goldenrods growing naturally in Missouri by allowing determinations based on vegetative characteristics observable throughout the growing season.

To use this key, one must be certain the specimen in question is indeed a goldenrod. Although goldenrods are quite distinct in vegetative morphology, they can be and often are mistaken for asters in terms of size, leaf shape, and overall stature. The subtle characters of each genus often transcend verbal description, but one can quickly narrow the focus by the following characters:

- If basal and lower stem leaves are cordate or truncate, it is not a goldenrod;
- If leaves are triple-nerved, it is not an aster;
- If crushed leaves smell like carrots, it is probably a goldenrod; if not, it is probably an aster;
- If the stem is branched below the inflorescence, it is probably an aster;
- If the stem is unbranched, it is probably a goldenrod (unless the tip is damaged);
- Goldenrod foliage tends to be somewhat yellowish green; aster foliage is almost always darker green to bluish green.

Once the specimen is determined to be a goldenrod, the following key will facilitate identification to species. Varieties are not addressed in the present work. Nomenclature follows that of Steyermark (1963), except for the transfer of the aberrant *Solidago ptarmicoides* from the genus *Aster* (Yatskievych and Turner, 1990).

1. Basal rosette present or lowest leaves of the stem larger than the middle and upper stem leaves (thus, leaves get smaller from base to tip of plant) [Note: as the growing season progresses the lower leaves may be dead and shriveled, thus requiring close examination]
   2. Leaves conduplicate (folded longitudinally along the mid-rib into two equal halves), linear, the margins entire but scabrous (roughened); restricted to wetlands . . . *S. riddellii*
   2. Leaves with flat, non-linear blades that are usually toothed (except sometimes in *S. speciosa*); found growing in various habitats
      3. Upper surface of leaf extremely scabrous; stems angled; plants of swampy meadows, fens, swampy thickets, and moist ledges of dripping limestone bluffs . . . . . *S. patula*
      3. Upper surface of leaf glabrous or with pubescence other than minute roughness; stems terete (circular in cross-section); plants of various habitats
         4. Leaves with a single prominent longitudinal nerve (single midvein)
            5. Leaves glabrous to glabrate on upper and lower surfaces; if glabrate, then hairs limited to the veins of the lower leaf surface
               6. Leaves extremely reduced toward the stem tip, becoming bract-like; basal leaves narrowly oblanceolate; primarily restricted to limestone and dolomite glades and rocky prairies of the Ozark region . . . . . *S. gattingeri*
               6. Leaves gradually reduced in size up the stem, mostly not bract-like; basal leaves wider; plants of various habitats and regions
                  7. Lower leaves entire to remotely few-toothed . . . . . *S. speciosa*
                  7. Lower leaves with conspicuous regular teeth

8. Leaves dark green; basal and lower stem leaves typically relatively broad and contracted abruptly to a definite petiole (although with some decurrent tissue); upper leaf surface darker green than lower surface, which often appears grayish green ..... *S. arguta*

8. Leaves light to olive-green; basal and lower stem leaves merely tapered to a petiole; upper and lower leaf surfaces essentially the same color ..... *S. juncea*

5. Leaves conspicuously pubescent on upper and/or lower surfaces

9. Pubescence of leaf surfaces hirtellous (short and dense), which gives them an unusual texture ranging from soft-scratchy to velvety

10. Basal leaves lacking decurrent tissue on the petiole; blade oblanceolate-elliptic; stem leaves sessile to clasping; inflorescence corymbiform ..... *S. rigida*

10. Basal leaves possessing decurrent tissue on the petiole; blade spatulate to oblanceolate; stem leaves tapering to the base; inflorescence paniculate ..... *S. nemoralis*

9. Pubescence of leaves (upper and/or lower surfaces) conspicuous and of variable density, but not short hirtellous or with an unusual texture

11. Entire plant with a uniformly dense pubescence creating a grayish caste; leaf margins variable, but usually more crenate (scalloped) than serrate (saw-toothed) ..... *S. hispida*

11. Plants much less densely pubescent; leaf margins variable, but usually more serrate than crenate

12. Leaves broadly ovate to elliptic-ovate and possessing distinct petioles derived from strongly but abruptly acuminate leaf bases; leaf pubescence long-hirsute and limited to the underside of blade; upper

leaf surface glabrous and smooth; leaf margins serrate with uniform jagged spreading teeth; stem forming a zigzag pattern . . . . . *S. flexicaulis*

12. Leaves lanceolate to elliptic and not possessing strongly acuminate bases; leaf pubescence hirsute (with relatively coarse somewhat curved hairs) and usually occurring on both surfaces of blade; upper leaf surface sparsely pubescent and slightly rugose (appearing wrinkled); leaf margins serrate or crenate but not uniformly jagged-spreading; stems straight . . . . . *S. ulmifolia*

4. Leaves with a prominent central nerve accompanied by two somewhat less conspicuous longitudinal nerves (triple-nerved; 3 main veins)
   13. Leaves ovate to elliptic-ovate; larger leaves with strongly acuminate leaf bases . . . *S. drummondii*
   13. Leaves lanceolate to oblanceolate, lacking acuminate bases
      14. Leaves possessing a "lacquered" sheen and divergent teeth, oblanceolate and long-petiolate; heads few; flowers white . . . . . *S. ptarmicoides*
      14. Not as above
         15. Leaves extremely reduced up the stem and becoming bract-like; plants lacking small fascicles of leaves in the axils of the upper stem leaves; found only on limestone and dolomite glades and rocky prairies of the Ozark region . . . . . *S. gattingeri*
         15. Stem leaves gradually reduced in size from lower to upper stem, not becoming bract-like; plants often with small fascicles of leaves in the axils of the upper stem leaves; found throughout the state in prairies, pastures, and woods . . . . . *S. missouriensis*

1. Basal rosettes absent (except in seedlings); leaves of the stem uniform in size or with larger (longer) leaves toward the

middle of the stem (lowest leaves of the stem are the smallest or same size as the leaves found mid- to mid-lower stem) [Note: shorter leaves of the lower stem may be few in number, dead or shriveled, thus requiring close examination]

16. Leaves conduplicate (folded along the midrib into two equal halves); leaves linear, the margins entire but scabrous; restricted to wetlands ..... *S. riddellii*
16. Leaves with flat, non-linear blades, the margins usually toothed; not restricted to wetlands
    17. Leaves with a prominent central nerve accompanied by two somewhat less conspicuous longitudinal nerves (triple-nerved; 3 main veins)
        18. Stems glabrous
            19. Stems (especially upper stems) often with fascicles of smaller leaves in axils of main leaves; leaves narrowly lanceolate; plants of prairies, open woods, and fields throughout Missouri ..... *S. missouriensis*
            19. Stems lacking axillary fascicles of smaller leaves; leaves usually lanceolate-elliptic to lanceolate; plants typically of moist habitats (i.e., along streams or in alluvial soils) ..... *S. gigantea*
        18. Stems pubescent
            20. Leaves with conspicuously acuminate bases, broadly elliptic and more or less petiolate ..... *S. drummondii*
            20. Leaves with obtuse or acute bases, lanceolate to narrowly elliptic and sessile
                21. Upper leaf surface slightly to moderately scabrous (slightly roughened to the touch); lower leaf surface with velvety pubescence ..... *S. altissima*
                21. Upper leaf surface strongly scabrous (like sandpaper); lower leaf surface hairy but lacking velvety pubescence ..... *S. radula*
    17. Leaves with a single prominent longitudinal nerve (single midvein)
        22. Leaves with minute depressed dots (hold leaf to light), anise-scented (like black licorice) when bruised ..... *S. odora*

22. Leaves lacking minute punctations, not anise-scented when bruised
    23. Leaves broadly elliptic to elliptic-ovate, with a distinct petiole below the abruptly acuminate base
        24. Stems densely pubescent; plants of bluffs and rocky outcroppings ..... *S. drummondii*
        24. Stems glabrous; plants of variable habitats ..... *S. flexicaulis*
    23. Leaves lanceolate to elliptic, lacking an abruptly acuminate base or a distinct petiole
        25. Leaves distinctly rugose, somewhat rounded at the base; lower stem leaves often distinctly scabrous ..... *S. rugosa*
        25. Leaves somewhat rugose to smooth, tapering to the base; lower stem leaves occasionally slightly scabrous to completely smooth
            26. Stems with a glaucus coating, forming a zigzag pattern (especially in the upper third) ..... *S. caesia*
            26. Stem lacking a glaucus coating, more or less straight (not zigzag)
                27. Leaves rather thick, firm, the broadest ones 1.4 2.0 cm wide, often lacking marginal serrations, the surfaces with a slight metallic sheen as though "lacquered", the lower surface slightly scabrous to glabrous; stems with very short, uniformly bent hairs of variable density ..... *S. petiolaris*
                27. Leaves relatively thin and flexible, the broadest ones more than 2.0 cm wide, usually with some degree of marginal serration, the surfaces without a "lacquered" sheen, the lower (and sometimes also upper) surface hirsute, at least along the veins; stems glabrous, tomentose or hirsute but without short abruptly bent hairs
                    28. Stems conspicuously tomentose; lowest stem leaves persistent and considerably

shorter and narrower than middle and upper leaves; leaves above the midpoint of the stem not or only slightly reduced in size toward the stem tip; upper leaf surface with a relatively smooth texture ..... *S. buckleyi*

28. Stems glabrous to hirsute, never tomentose; lowest stem leaves often withering or shed early, equal to or larger than the middle and upper leaves; leaves above the midpoint of the stem noticeably reduced in size; upper leaf surface slightly and subtly scabrous ..... *S. ulmifolia*

LITERATURE CITED

Steyermark, J. A. 1963. *Flora of Missouri*. Iowa State University Press, Ames [errata added at second printing, 1968].

Yatskievych, G., and J. Turner. 1990. Catalogue of the flora of Missouri. Monogr. Syst. Bot. Missouri Bot. Gard. 37:i xii, 1 345.

Thlaspi alliaceum (Brassicaceae), Another Non-native Species New to Missouri

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New distributional records are discovered each year in Missouri, in spite of the state's rightful claim as one of the best-botanized states in the country. Since the publication of Steyermark's (1963) Flora of Missouri, about 300 state records of vascular plants have been reported (Yatskievych, 1999). Regrettably, the number of exotic species has risen faster than the list of native species, and the proportion of Missouri's botanical diversity that is of alien origin has risen from about 23% to nearly 28 percent during the past 40 years (Yatskievych and Raveill, 2001).

Thus, it is with some regret that we add yet another introduced plant to the state's register. In May 2001, while photographing wildflowers in Platte county for a World Wide Web site on the Missouri flora (www.missouriplants.com), the senior author encountered a large population of an unknown member of the mustard family. After puzzling over the plant for some time, a specimen was sent to the Flora of Missouri Project for more detailed study. The plant in question was found to represent a westward expansion of the North American range of *Thlaspi alliaceum* L., commonly known as roadside pennycress or garlic pennycress.

VOUCHER DATA. **Platte County**: Dr. Frederick Marshall Conservation Area, on W side of Platte river ca. 2 air mi E of East Leavenworth, abundant in flat open floodplain area, 6 May 2001, *D. Tenaglia s.n.* (MO).

Thlaspi alliaceum is distinctive in that it is usually taller than the other two pennycresses in Missouri, *T. arvense* L. and *T. perfoliatum* L. In fact, in some ways it superficially resembles the distantly related *Camelina* in habit, but with smaller white flowers. However, the fruits have a marginal wing, as is typical of other *Thlaspi* species. It is unique among Missouri members of *Thlaspi*

in having stems with moderate to sparse, long, spreading hairs at the base (the others are glabrous) and in its faint garlic odor when bruised or crushed. The fruits of *T. alliaceum* are smaller and more turgid than those of *T. arvense* and more narrowly winged than those of *T. perfoliatum*. Each of the two locules contains 2 4 seeds, which are reddish brown at maturity and have a reticulate surface (vs. tan to light orange and smooth in *T. perfoliatum*; brown with concentric ridges in *T. arvense*). Superficially, plants might be confused with those of *T. perfoliatum*, but *T. alliaceum* tends to be taller (to 75 cm) and has more strongly appressed-ascending stem leaves. For photographs of all three *Thlaspi* species that occur in Missouri, visit the www.missouriplants.com website, select the option for white-flowered plants with alternate leaves, and scroll down to the ninth screen.

Thlaspi alliaceum is a native of southern Europe and has expanded its range on that continent during historical times (Meyer, 2001). In North America, the species was first collected as an adventive during the early 1960s in North Carolina (Radford et al., 1964). Subsequently, it was reported from Kentucky and Indiana (Thieret and Baird, 1985). The range has continued to expand rapidly and now includes portions of Indiana, Kentucky, Louisiana, North Carolina, Ohio, Pennsylvania, Tennessee, and Virginia (Kartesz and Meacham, 1999; Chester and Wofford, 2000). The Missouri population is the farthest west that the species has been documented to grow so far. Curiously, it was not mentioned by Gleason and Cronquist (1991) and has not yet been reported for Illinois.

Roadside pennycress grows in disturbed open sites. Most of the known populations occur in floodplain areas, along roadsides, or the margins of crop fields. Occasionally it has spread to pastures, but thus far has not become invasive in native plant communities in the United States. Like most other mustards, it flowers in the early spring, beginning in late March, begins producing often copious fruits very early in the flowering cycle, and is mostly in fruit by the middle of May. Missouri botanists should be alert for other populations of this plant, which might turn up in any county.

LITERATURE CITED

Chester, E. W., and B. E. Wofford. 2000. Noteworthy collections Tennessee. Castanea 65:168 170.

Gleason, H. A., and A. Cronquist. 1991. Manual of Vascular Plants of Northeastern United States and Adjacent Canada, ed. 2. New York Botanical Garden, Bronx.

Kartesz, J. T., and C. A. Meacham. 1999. Synthesis of the North American Flora, ver. 1.0. North Carolina Botanical Garden, Chapel Hill, NC. [CD-ROM].

Meyer, F. K. 2001. Kritische Revision der "*Thlaspi*"-arten Europas, Afrikas, und Vorderasien. Spezieller Teil. I. *Thlaspi* L. Hausssknechtia 8:3 42.

Radford, A. E., H. E. Ahles, and C. R. Bell. 1964. Manual of the Vascular Flora of the Carolinas. University of North Carolina Press, Chapel Hill..

Steyermark, J. A. 1963. Flora of Missouri. Iowa State University Press, Ames [errata added at second printing, 1968].

Thieret, J. W., and J. R. Baird. 1985. *Thlaspi alliaceum* (Cruciferae) in Kentucky and Indiana. Trans. Kentucky Acad. Sci. 46:143 145.

Yatskievych, G. 1999. Steyermark's Flora of Missouri, revised ed., vol. 1. Missouri Department of Conservation, Jefferson City.

Yatskievych, G., and J. A. Raveill. 2001. Notes on the increasing proportion of non-native angiosperms in the Missouri flora, with reports of three new genera for the state. Sida 19:701 709.